Project Report: Establishment of the Goddard Analytical Astrobiology Laboratory

Project Investigator: ***Jason Dworkin***

Project Progress

Establishment of the Goddard Analytical Astrobiology Laboratory

Construction:

This year Dworkin and his team completed construction of the laboratory infrastructure in Goddard Space Flight Center (GSFC) building 2, room W109 (Fig. 1). Since then we have focused on purchasing the best analytical tools for determining the organic composition of the material generated in the Cosmic Ice and Cosmic Dust Laboratories. These are liquid chromatography–time of flight mass spectroscopy (LC/MS–ToF) and gas chromatography–mass spectroscopy (GC/MS).

- LC/MS–ToF (Waters 2695XE HPLC attached to Waters LCT Premier): Injected material flows through a ultraviolet (UV)–Visible diode array and UV fluorescence detectors to the time of flight mass spectrometer with an ESI source. The MS has a mass accuracy of >3 ppm, a resolution of 10,000, and a range of 20 to 30,000 m/z. Installation is expected on July 30, 2004.

- GC/MS (Thermo Finnigan Trace DSQ): This GC/MS has as a mass range from 1–1050 amu, with a scan rate up to 10,000 amu/sec. Installation is expected by August 7, 2004.

In addition, we have recruited two half time researchers (G. Ertem and M. Martin), one graduate student (M. Pasek, advisor: D. Lauretta, U.A.), and one undergraduate (S. Tsitrin, Fall 2004) to help with the analyses.

Fig 1. Astrobiology Analytical Lab before (left) and after (right) construction. Brochures show equipment that has been ordered.

Research:

We have started work on the analysis of the products of the irradiation of various nitriles in water ices using an old GC/MS. We will resume this work as well as begin work on glycolaldehyde when our new GC/MS arrives. We have synthesized autofluorescent membranes (Fig. 2) and possibly vesicles from a realistic interstellar ice mixture (H_2O, CH_3 OH, NH_3, and CO at 15K) under high vacuum via irradiation with various fluxes of 0.8 MeV protons, to simulate cosmic–ray bombardment. The properties of these membranes are being characterized by collaborator D. Deamer (University of California, Santa Cruz).

Fig 2. Micrograph of fluorescent membranous material.

Highlights

- We have completed research and leveraged funds to purchase equipment for analysis of organic compounds.
- We have synthesized autofluorescent membranes from realistic interstellar ice mixtures with proton irradiation.